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APPLICANT : CANON INC;

INVENTOR : AKAHIRA MAKOTO;

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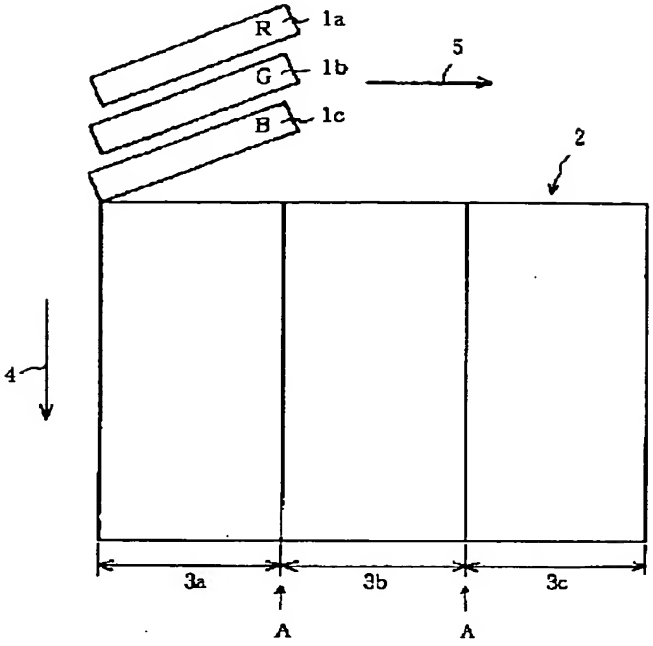
TITLE : COLOR FILTER, ITS PRODUCTION, DEVICE THEREFOR AND LIQUID CRYSTAL DEVICE USING SAID COLOR FILTER



ABSTRACT : PROBLEM TO BE SOLVED: To prevent the development of irregular color in the boundary part between scanning regions by dividing a region to be colored into plural scanning regions and imparting different amounts of ink to a part to be colored in the boundary part between the adjacent scanning regions and to other parts to be colored.

SOLUTION: The device has a stage on which a transparent substrate as a constituent member of a color filter is mounted and an ink jet head 1 which imparts inks to parts to be colored on the substrate. The ink jet head 1 has plural nozzles for every color and a means of independently controlling the amount of ink jetted from every nozzle. When ink is imparted to each part to be colored, it is imparted as mists and inks are simultaneously imparted to plural parts to be colored by using the ink jet head 1 having plural nozzles for every color. A region 2 to be colored is divided into plural scanning regions 3 in the scanning direction of the ink jet head 1 and different amounts of ink are imparted to a part to be colored in the boundary part between the adjacent scanning regions 3 and to other parts to be colored.

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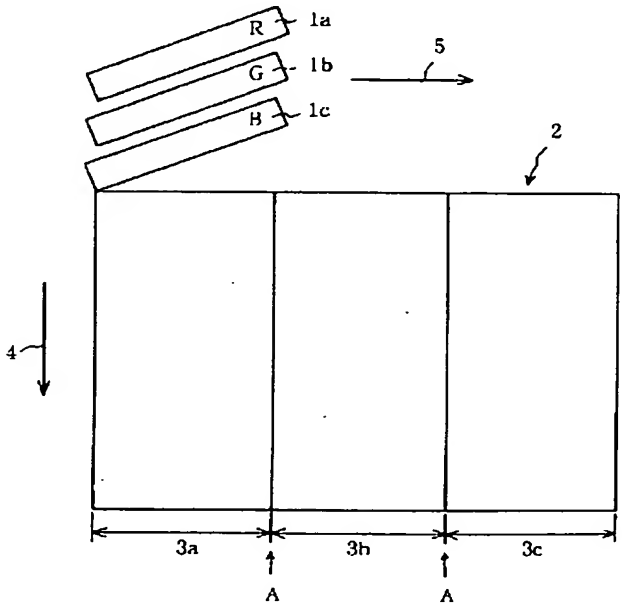
最終頁に続く

(54)【発明の名称】　カラーフィルタとその製造方法、製造装置、該カラーフィルタを用いた液晶素子

(57)【要約】
【課題】　インクジェット方式を用いて、大型で色むらの少ないカラーフィルタを歩留良く製造する。
【解決手段】　複数のノズルを有するインクジェットヘッド１ａ～１ｃを用い、着色領域２を複数の走査領域３ａ～３ｃに分割し、インクジェットヘッド１ａ～１ｃをシフト方向５にシフトしながら被着色部にインクを付与する工程において、発生した色むらに対応して被着色部毎に付与されるインク量を修正する。



【発明が解決しようとする課題】インクジェット方式によるカラーフィルタの製造方法において、色毎に複数のノズルを有するインクジェットヘッドを用いることにより、着色工程は大幅に時間が短縮される。しかしながら、複数のノズルを用いてカラーフィルタを形成した場合には、画素毎の色むらが生じ易く、特に、大型のカラーフィルタをノズルの個数に合わせて複数の走査領域に分割して、着色走査した場合に隣接する走査領域の境界部が他の部分とは異なる濃度に見える場合が多い。

【０００７】上記した着色領域を複数の走査領域に分割してインクを付与する（描画する）場合の着色領域とインクジェットヘッドの関係を図１に模式的に示す。図中、１ａ～１ｃはＲ、Ｇ、Ｂの各色のインクジェットヘッド、２は着色領域全体、３ａ～３ｃは走査領域、４はインクジェットヘッドの走査方向、５はインクジェットヘッドのシフト方向を示す。図１では、Ｒ、Ｇ、Ｂ１セットのインクジェットヘッド１ａ～１ｃをカラーフィルタの着色部を形成する基板の各走査領域３ａ～３ｃに対して図中の走査方向４に走査させながら所定の被着色部に各ノズルよりインクを付与して着色部を形成する。図１に示したように、大型の基板で走査方向４の移動だけでは着色領域２全体にインクを付与できない場合には、インクジェットヘッド１ａ～１ｃを図中のシフト方向５にずらせて再び走査させる。従って、着色領域２はインクジェットヘッド１ａ～１ｃのシフト位置により走査領域３ａ～３ｃに分割される。また、各走査領域３ａ～３ｃに対応して、インクジェットヘッド１ａ～１ｃのセットを３セット用意することにより、インクジェットヘッドをシフトさせることなく短時間で着色領域２全体の着色走査を行なうこともできる。

【０００８】いずれの場合においても、隣接する走査領域間に境界Ａが存在し、該境界Ａとその周辺（境界部）において、目視により色むらが観察され易い。その原因として、当該境界Ａ近傍の画素が該境界から離れた画素と以下の点において異なることが考えられる。

【０００９】（１）境界部において、異なる領域の画素がそれぞれ着色される時間的ずれが大きい。

【００１０】（２）インクジェットヘッドをシフトさせて用いる場合、境界部の画素にインクを付与するノズルの位置がインクジェットヘッド内でも大きく離れているため、近接するノズル同士よりも、吐出するインク液滴量や着弾位置などの物理量の違いが大きい。

【００１１】（３）走査領域毎に異なるインクジェットヘッドのセットを用いる場合、異なるインクジェットヘッドのノズルから吐出するインク液滴量や着弾位置などの物理量の違いが同じインクジェットヘッドのノズルよりも大きい。

【００１２】インクジェット方式を用いたカラーフィルタの製造方法としては、大きく分けて２種類有り、第一は、インク吸収性を有する樹脂組成物層にインクを付与して該樹脂組成物層を着色して着色部とする方法、第二は、隔壁部で囲まれた領域にインクを付与し、該インク自体を硬化して着色部とする方法である。それぞれの方法において、上記のようなインクジェットヘッド及びノズルによる違いが、色むらの原因となるメカニズムは以下のように推定される。

【００１３】（第１の方法）

（ａ）インクジェットヘッドをシフトさせて用いる場合、先に着色走査した走査領域は、次の走査領域よりも次の工程（インクの乾燥工程や樹脂組成物層の硬化工程）に至る時間が長いため、着色材の分布が異なり、目視による観察に影響を与える。

【００１４】（ｂ）画素からインクの成分が時間経過とともに境界部を越えて隣接する画素まで浸透し、隣接画素内の着色材の分布に影響を与え、結果として隣接画素内の着色材分布が異なり、目視による観察に影響を与える。

【００１５】（ｃ）着弾位置の違いが画素内の着色材分布に影響を与え、目視による観察に影響を与える。

【００１６】（第２の方法）

（ｄ）付与されるインク量の違いが画素の厚みの違いとなり、濃度差を生じて目視による観察に影響を与える。

【００１７】（ｅ）着弾位置の違いが、画素内に厚みの偏りを生じ、濃度差を生じて目視による観察に影響を与える。

【００１８】これらの要因を含めて、境界部の色むらの影響を軽減するために、１走査領域の着色工程を複数回の走査によって行ない、各走査毎にインクジェットヘッドを若干シフトさせ、隣接する走査領域を一部重複して、境界部の影響を分散させる方法が効果的である。その場合の着色領域を図２に模式的に示す。図２中、６は重複領域であり、図１と同じ部材には同じ符号を付した。図２に示されるように、隣接する走査領域３ａと走査領域３ｂとを重複領域６を介して重複させ、それぞれ１回の走査で必要なインク量の１／３ずつを付与しながら３走査行ない、各走査毎にシフト方向にインクジェットヘッドをずらす。その結果、各被着色部には３個の異なるノズルからインクが付与されることになる。

【００１９】しかしながら、このようにして着色したとしても、当該重複領域において、空間的になだらかな色むらが目視により観察されることがある。

【００２０】本発明の目的は、インクジェット方式によるカラーフィルタの製造方法において、複数のノズルを有するインクジェットヘッドを用い、着色領域を複数の走査領域に分割することにより発生する隣接走査領域の境界部の色むらを防止することにあり、さらには、該製造方法に用いる製造装置、該製造方法による高品質のカラーフィルタを提供し、該カラーフィルタを用いてカラー表示に優れた液晶素子を提供することにある。

【００２１】

【００３３】また、ブラックマトリクスは後述する樹脂組成物層１３を形成した後、或いは樹脂組成物層１３を着色後に該樹脂層上に形成したものであっても特に問題はない、またその形成方法としては、スパッタもしくは蒸着により金属薄膜を形成し、フォトリソ工程によりパターニングする方法が一般的であるが、それに限定されるものではない。

【００３４】工程（ｂ）

基板１１上に、光照射或いは光照射と熱処理によって硬化し、光照射部分のインク吸収性が低下する樹脂組成物を塗布し、必要に応じてプリベークを行なって、樹脂組成物層１３を形成する。このような樹脂組成物の基材樹脂としては、アクリル系、エポキシ系、アミド系などの樹脂が用いられるが、特にこれらに限定されるものではない。これらの樹脂で、光或いは光と熱の併用によって架橋反応を進行させるために、光開始剤（架橋剤）を用いることも可能である。光開始剤としては、重クロム酸塩、ビスアジド化合物、ラジカル系開始剤、カチオン系開始剤、アニオン系開始剤等が使用可能である。また、これらの光開始剤を混合して、或いは他の増感剤と組み合わせて使用することもできる。さらに、オニウム塩などの光酸発生剤を架橋剤と併用することも可能である。尚、架橋反応をより進行させるために、光照射後に熱処理を施しても良い。

【００３５】また、樹脂組成物層１３の形成には、スピンコート、ロールコート、バーコート、スプレーコート、ディップコート等の塗布方法を用いることができ、特に限定されるものではない。

【００３６】工程（ｃ）

フォトマスク１４を用いて、ブラックマトリクス１２で遮光される領域の樹脂組成物層にパターン露光を行なうことにより、硬化させてインク吸収性を低下させ、非着色部１５を形成する。露光されなかった領域はインク吸収性が高く被着色部１６となる。非着色部１５は必ずしも必要ではないが、隣接する被着色部１６間にインク吸収性の低い非着色部１５を介在させることにより、隣接する着色部間での混色を防止することができる。ここで用いるフォトマスク１４は、ブラックマトリクス１２による遮光部分を硬化させるための開口部を有するものを使用するが、ブラックマトリクス１２に接する部分での色抜けを防止するために、ブラックマトリクスの遮光幅よりも狭い開口部を有するマスクを用いることが好ましい。

【００３７】工程（ｄ）

インクジェットヘッド１７より、被着色部１６にＲ、Ｇ、Ｂの各色のインク１８を所定の着色パターンに応じて付与し、着色部（画素）１９を形成する。本発明においては、被着色部毎に付与されるインク量が制御される。

【００３８】着色に用いるインクとしては、色素系、顔料系共に用いることが可能であり、また、液状インク、ソリッドインク共に使用可能であるが、水性インクを用いる場合には、樹脂組成物層１３を吸水性の高い樹脂組成物で形成しておくことが好ましい。また、常温で液体のものに限らず、室温やそれ以下で固化するインクであって、室温で軟化するもの、もしくは液体であるもの、或いは通常のインクジェット方式ではインク自体を３０℃～７０℃の範囲内で温度調整を行ってインクの粘性を安定な範囲に制御していることから、インク吐出時にインクが液状をなすものが好適に用いられる。

【００３９】さらに、インクジェット方式としては、エネルギー発生素子として電気熱変換体を用いたバブルジェットタイプ、或いは圧電素子を用いたピエゾジェットタイプ等が使用可能であり、着色面積及び着色パターンは任意に設定することができる。

【００４０】工程（ｅ）

必要に応じてインクの乾燥を行なった後、基板全面に光照射して着色部１９を硬化させる。光照射の代わりに熱処理を施しても良い。

【００４１】工程（ｆ）

必要に応じて保護層２０を形成する。保護層２０としては、光硬化タイプ、熱硬化タイプ或いは光熱併用タイプの樹脂層や、蒸着、スパッタ等によって形成される無機膜等を用いることができ、カラーフィルタとした場合の透明性を有し、その後のＩＴＯ形成プロセス、配向膜形成プロセス等に耐え得るものであれば使用可能である。

【００４２】また、樹脂組成物として、光照射または光照射と熱処理によりインク吸収性が増加（或いは発現）する樹脂組成物を用いる場合、このような樹脂組成物としては、具体的には化学増幅による反応を利用する系が好ましく、基材樹脂としては、ヒドロキシプロピルセルロース、ヒドロキシエチルセルロース等のセルロース誘導体の水酸基をエステル化したもの或いはアセチル基等によってブロックしたもの（例：酢酸セルロール系の化合物など）；ポリビニルアルコール等の高分子アルコール及びそれらの誘導体の水酸基をエステル化したもの或いはアセチル基等でブロックしたもの（例：ポリ酢酸ビニル系の化合物など）；クレゾールノボラック等のノボラック樹脂、ポリパラヒドロキシスチレン及びそれらの誘導体の水酸基を例えばトリメチルシリル基でブロックしたもの等が用いられるが、本発明がこれらに限定されるものではない。

【００４３】本発明において、露光によりインク吸収性に実質的な差を生じさせるためには、一般的には親水基に変換可能な官能基の親水基への変換率が３０％以上であることが好ましい。この場合の親水基定量法としては、ＩＲ、ＮＭＲ等のスペクトル分析が有効である。

【００４４】また、光開始剤としては、トリフェニルスルホニウムヘキサフルオロアンチモネート等のオニウム塩、トリクロロメチルトリアジン等のハロゲン化有機化

２をノズルが３００個のインクジェットヘッドを各色１本ずつ用い、各走査領域毎に複数回の走査でインクを付与する。尚、複数回のインクを付与するノズルは、被着色部毎に同一である。従って、シフト方向３００画素毎（例えば、１番目の画素と３０１番目の画素と６０１番目の画素）の被着色部にインクを付与するノズルは同じである。

【００５９】各ノズルから付与するインク量は、予め各ノズルから吐出されるインク量を測定することによって、各被着色部に付与されるインク量が一定になるように、ノズル毎に独立にインク液滴を調整する。このようにして形成されたカラーフィルタを、１色のみが観察できるような治具を介して観察すると、境界Ａを含む境界部３１ａ、３１ｂに色むらが観察されることがある。このような場合には、例えば、ＣＣＤカメラ等を用いて、Ａ周辺と、走査領域３ａ～３ｃの中央部をそれぞれ複数点ずつ撮影し、輝度を比較する。

【００６０】得られた輝度より、境界部３ａ、３ｂの各画素の被着色部へ付与するインク量を修正する。この時、修正後に得られたカラーフィルタにおいてインク量を修正した画素と修正していない画素との間で新たな色むらが発生する恐れがあるため、インク量の修正は画素の位置によってなだらかに変化させることが好ましい。

【００６１】このように、色むらの発生状況に応じて、少なくとも境界部の被着色部のインク量を変化させることによって、色むらのないカラーフィルタを製造することができる。

【００６２】（実施形態２）実施形態１と同じカラーフィルタを、互いに重複する複数の走査領域に分割して製造する例について説明する。図８にその着色領域を模式的に示す。本実施形態では、色毎に２０６個のノズルを有するインクジェットヘッドを用いる。着色領域２は４分割し、それぞれシフト方向５に走査領域３ａが２０６画素、３ｂと３ｃがそれぞれ２３０画素、３ｄが２０６画素で、重複領域３１ａ～３１ｃは２４画素である。各走査領域３ａ～３ｄにはそれぞれ３回走査によってインクが付与され、走査毎に図２に示したようにインクジェットヘッドをシフト方向５にずらせるため、各被着色部は異なる３個のノズルよりインクが付与される。従って、各ノズルはシフト方向には２０６画素周期で繰り返す。つまり、図８に示すように、例えば１画素目、２０７画素目、４１３画素目、６１９画素目の被着色部には同じノズルからインクが付与され、インクジェットヘッドの左端のノズルを１番目とすると、２５番目、１３番目、１番目のノズルからインクが付与される。以下、この周期を画素構成の周期と呼ぶ。従って、２０６画素以上の連続した画素について透過光量を調べれば、８００画素全体の画素の測定値を推定することができる。

【００６３】透過光量を測定する範囲としては、図９に示したように、１個の境界（重複領域）３１ａ（或いは、３１ｂ、３１ｃ）を少なくともまたぐ連続する２０６画素以上の範囲５１が好ましいが、例えば図１０に示すように、測定範囲を５１ａと５１ｂの二つ或いはそれ以上の複数に分けても良い。

【００６４】尚、走査方向の透過光量の測定は、１画素以上であれば良いが、ある程度離れた位置の画素を複数点選択して平均することが好ましく、好ましくは１０画素以上、望ましくは３０画素以上測定する。

【００６５】図１１は透過光量の測定機の模式図であり、図中４１はＣＣＤカメラ、４２は光源、４３は透明なＸＹステージ、４４は被測定基板であるカラーフィルタ、４５はＸＹステージ４３のドライバ、４６はコンピュータである。

【００６６】また、図１３は、透過光量測定時のカラーフィルタ周辺の拡大模式図である。当該カラーフィルタは図５の工程で得られたものであり、図中の４７はＣＣＤカメラのレンズである。この時、望ましくは、各画素の透過光量をカラーフィルタ画素よりも小さい単位からなる画像データとしてコンピュータにメモリすることが望ましい。その理由は、画像データを画素内のインク量分布を考慮に入れたデータとして処理するなど、処理の選択幅を広げることができるからである。

【００６７】カラーフィルタの基板側から照射された光は、カラーフィルタの画素（着色部１９）を透過してＣＣＤカメラ４１で検出され、その光量はＡＤ変換されてコンピュータ４６にメモリされる。この透過光量は画素が均一に着色されている場合には、画素に付与されたインク量を厳密に反映しているが、画素に濃度分布がある場合など、インク量と透過光量が正確に対応しないことが予想される。従って、透過光量を測定し、得られた透過光量のデータに応じて、インク量を調整することによって、色むらを防止することができる。カラーフィルタ画素の大きさや形によっては、この透過光量のデータを一次データとして加工することによって各被着色部へのインクの付与量を決定しても良い。

【００６８】また、インク量の変化率に伴う透過光量の変化率を予め求めておくことにより、各画素が全て同じ透過光量となるように、インク量を調整することも好ましい。

【００６９】本実施形態においては、図８に示したように走査方向が着色領域の外周を構成する辺のいずれかと平行となるように設定したが、本発明においては特にこれに限定されるものではなく、図１３に示すように、走査方向と着色領域２の外周を構成する辺のいずれもが平行にならないように構成しても構わない。

【００７０】また、このようにカラーフィルタ画素の透過光量の測定結果を色むらの評価に使用することにより、カラーフィルタの色むらの良否判定も同時に行うことができ、当該判定結果が不良の場合、迅速に各被着色部に付与するインク量の目標値を設定し直すことができ

画素、２００画素とし、重複領域は２４画素とした。各走査領域には３回走査によってインクを付与し、走査毎にノズル１２個分インクジェットヘッドをずらせた。

【００８４】着色工程後、樹脂組成物層全体を硬化させ、得られたカラーフィルタについて、図１１の測定機を用いて図９に示すように重複領域１箇所をまたいで連続する３００画素について透過光量を測定した。走査方向については１画素離れた３画素について測定し、平均した。Ｂ画素の透過光量の分布を図２０に示す。図２０に示すように、本実施例のカラーフィルタは、走査領域間の境界である１８３番目～２３０番目の画素を中心に透過光量が大きく異なっていることがわかった。そこで、当該データに基づいて、１８３～２３０番目の画素の透過光量が１．００になるように、当該画素の被着色部へのインク付与量を修正した。同様にして、Ｒ画素、Ｇ画素についても透過光量を測定し、インク付与量を修正した。修正後に製造されたカラーフィルタについては、目視による色むらは認められなかった。

【００８５】

【発明の効果】以上、説明したように、本発明によれば、複数の走査領域に分割して着色するカラーフィルタにおいて、境界部に発生する色むらを防止することができる。また、製造ラインにおいて本発明を組み込むことにより、色むらの発生に迅速に対応することができ、高歩留を維持することができる。よって、本発明のカラーフィルタを用いて、カラー表示特性に優れた液晶素子を安価に提供することが可能となる。

【図面の簡単な説明】

【図１】本発明の製造方法にかかる、着色領域とインクジェットヘッドとの位置関係を示す模式図である。

【図２】本発明の製造方法にかかる着色領域において、隣接する走査領域が重複する場合を示す模式図である。

【図３】本発明にかかる境界部を示す模式図である。

【図４】本発明にかかる境界部を示す模式図である。

【図５】本発明の製造方法の一例の工程図である。

【図６】本発明の製造方法の他の例の工程図である。

【図７】本発明の実施形態１における走査領域と境界部を示す模式図である。

【図８】本発明の実施形態２における走査領域と画素構成の周期を示す模式図である。

【図９】本発明の実施形態２における測定範囲を示す模式図である。

【図１０】本発明の実施形態２における他の測定範囲を示す模式図である。

【図１１】本発明にかかるカラーフィルタの画素の透過光量の測定機の模式図である。

【図１２】図１１の測定機による透過光量測定時のカラーフィルタ周辺の拡大図である。

【図１３】本発明の実施形態２において、インクジェットヘッドのシフト方向、走査方向を変更した例を示す模式図である。

【図１４】本発明の実施形態３における走査領域と測定範囲を示す模式図である。

【図１５】本発明の実施形態４における走査領域と画素構成の周期を示す模式図である。

【図１６】本発明の実施形態４における走査領域と測定範囲を示す模式図である。

【図１７】本発明の実施形態４における他の測定範囲を示す模式図である。

【図１８】本発明の液晶素子の一例の断面模式図である。

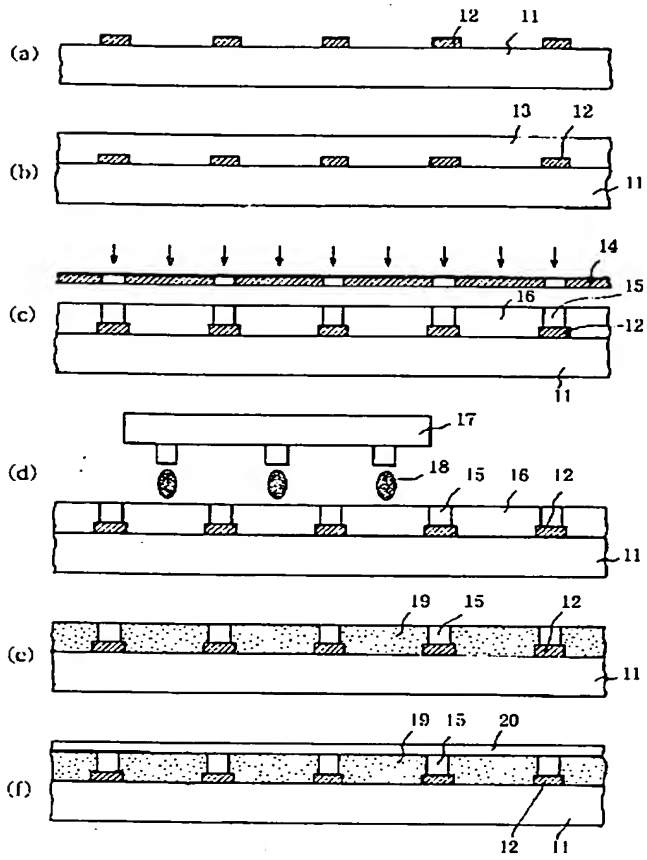
【図１９】本発明の液晶素子の一例の断面模式図である。

【図２０】本発明の実施例２におけるＢ画素の透過光量の分布を示す図である。

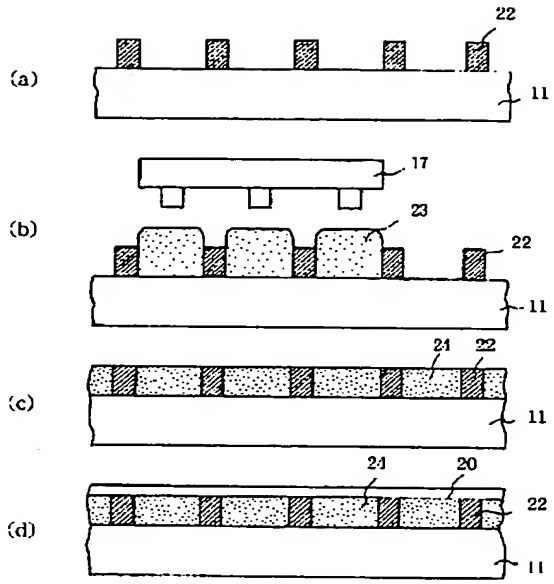
【符号の説明】

１ａ～１ｃ　インクジェットヘッド
２　着色領域
３ａ～３ｄ　走査領域
４　走査方向
５　シフト方向
６、６ａ～６ｃ　重複領域
１１　透明基板
１２　ブラックマトリクス
１３　樹脂組成物層
１４　フォトマスク
１５　非着色部
１６　被着色部
１７　インクジェットヘッド
１８　インク
１９　着色部
２０　保護層
２２　ブラックマトリクス
２３　インク
２４　着色部
３１ａ、３１ｂ　境界部
４１　ＣＣＤカメラ
４２　光源
４３　ＸＹステージ
４４　カラーフィルタ
４５　ドライバ
４６　コンピュータ
４７　レンズ
５１、５１ａ、５１ｂ　測定範囲
６２　共通電極
６３　配向膜
６５　基板
６６　画素電極
６７　配向膜
６８　液晶化合物

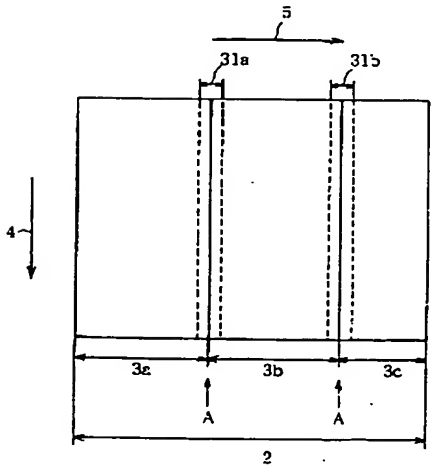
【図5】


(a)
12
11
(b)
13
12
11
(c)
14
15
16
12
11
(d)
17
18
15
16
12
11
(e)
19
15
12
11
(f)
19
15
20
12
11

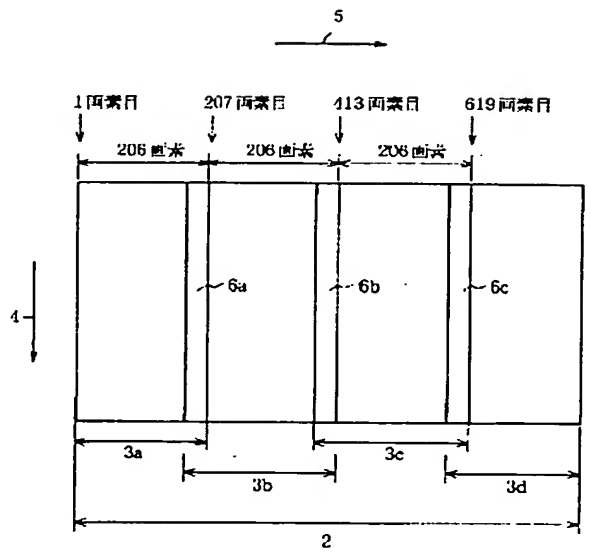
【図6】


(a)
22
11
(b)
17
23
22
11
(c)
21
22
11
(d)
24
20
22
11

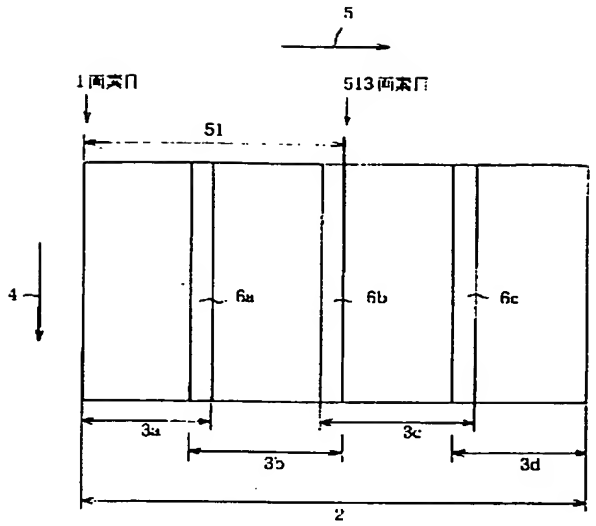
【図7】


5
31a
31b
4
3a
3b
3c
A
A
2

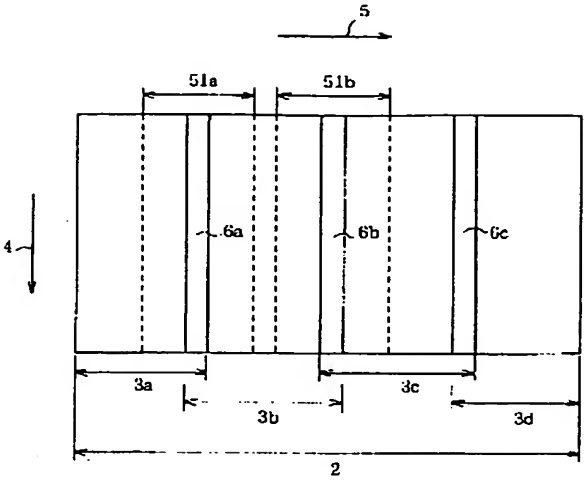
【図8】


5
1画素目
207画素目
413画素目
619画素目
206画素
206画素
206画素
6a
6b
6c
4
3a
3b
3c
3d
2

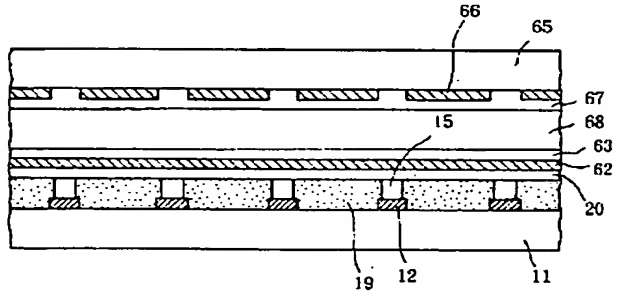
【図15】



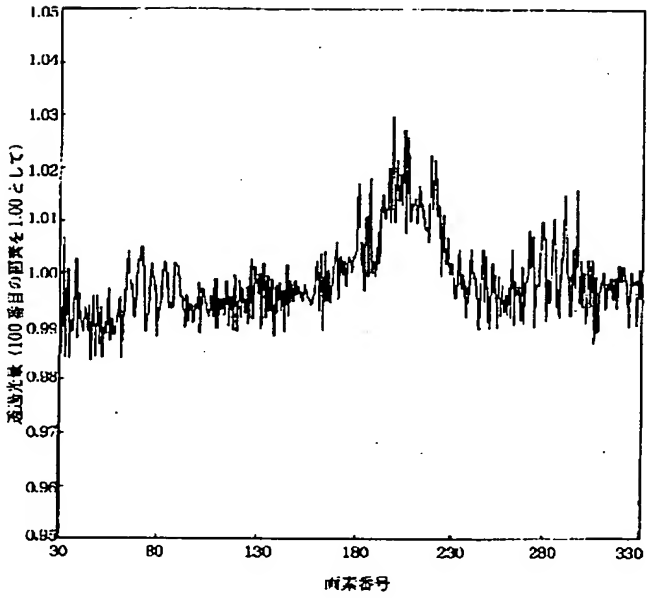
【図17】



【図18】



【図20】



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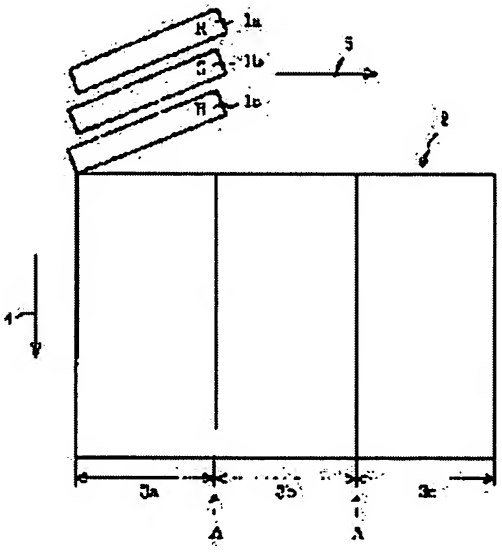
(54) COLOR FILTER, ITS PRODUCTION, DEVICE THEREFOR AND LIQUID CRYSTAL DEVICE USING SAID COLOR FILTER

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent the development of irregular color in the boundary part between scanning regions by dividing a region to be colored into plural scanning regions and imparting different amounts of ink to a part to be colored in the boundary part between the adjacent scanning regions and to other parts to be colored.



SOLUTION: The device has a stage on which a transparent substrate as a constituent member of a color filter is mounted and an ink jet head 1 which imparts inks to parts to be colored on the substrate. The ink jet head 1 has plural nozzles for every color and a means of independently controlling the amount of ink jetted from every nozzle. When ink is imparted to each part to be colored, it is imparted as mists and inks are simultaneously imparted to plural parts to be colored by using the ink jet head 1 having plural nozzles for every color. A region 2 to be colored is divided into plural scanning regions 3 in the scanning direction of the ink jet head 1 and different amounts of ink are imparted to a part to be colored in the boundary part between the adjacent scanning regions 3 and to other parts to be colored.

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[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

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CLAIMS

[Claim(s)]
[Claim 1] In the process which is the manufacture approach of the color filter which gives ink to the covering color part on a transparence substrate with an ink jet method, and forms the coloring section, and gives two or more liquid ink drops for every covering color part Ink is given at coincidence to two or more covering color parts using the ink jet head which has two or more nozzles for every color. The manufacture approach of the color filter which divides a coloring field into two or more scan fields parallel to the scanning direction of an ink jet head, and is characterized by setting up so that the amounts of ink given by the covering color part of the boundary section of an adjoining scan field and covering color parts other than this boundary section may differ at least.
[Claim 2] The manufacture approach of a color filter according to claim 1 with the same ink jet head which colors an adjoining scan field.
[Claim 3] The manufacture approach of a color filter according to claim 1 that the ink jet heads which color an adjoining scan field differ.
[Claim 4] The manufacture approach of a color filter according to claim 1 of having the field where the scan field which performs the coloring process of each scan field by the scan of multiple times, can shift an ink jet head to an adjoining scan field side for every scan, and adjoins overlaps mutually.
[Claim 5] The manufacture approach of a color filter according to claim 1 of adjusting the amount of ink which measures the amount of transmitted lights of the coloring section of the boundary section of the scan field which adjoins at least, and is given to each covering color part on a new substrate based on this measurement result.
[Claim 6] The manufacture approach of a color filter according to claim 5 of setting up the amount of targets of the amount of ink which asks for the relation of the variation of the amount of transmitted lights of the coloring section to the variation and this variation of the amount of ink given from an ink jet head beforehand, and is given to each covering color part based on the relation concerned.
[Claim 7] The manufacture approach of the color filter according to claim 5 which considers the above-mentioned measurement result as evaluation of the irregular color of a measured color filter.
[Claim 8] The manufacture approach of the color filter according to claim 1 which carries out the resin constituent stratification, gives ink to this covering color part with an ink jet method, and forms the coloring section of having the covering color part which has ink absorptivity on a transparence substrate.
[Claim 9] On a transparence substrate, the resin constituent layer which falls or increases ink absorptivity by an optical exposure or an optical exposure, and heat treatment is formed, and optical exposure or optical exposure, and heat treatment are performed to the predetermined field of this resin constituent layer. The high covering color part of ink absorptivity, The manufacture approach of a color filter according to claim 8 of forming the non-coloring section with ink absorptivity lower than this covering color part, an ink jet method giving ink to the above-mentioned covering color part, coloring this covering color part, forming the coloring section, and making the whole resin constituent layer performing and hardening an optical exposure or heat treatment.
[Claim 10] The manufacture approach of the color filter according to claim 1 which forms the septum member which encloses a covering color part, gives the ink hardened by energy grant to this covering color part with an ink jet method, gives energy, is made to harden this ink, and forms the coloring section on a transparence substrate.
[Claim 11] The manufacturing installation of the color filter characterized by having a means to control independently the amount of ink which is the color filter manufacturing installation equipped with the stage in which a transparence

substrate is laid, and the ink jet head which gives ink to the covering color part on this substrate, and the above-mentioned ink jet head has two or more nozzles for every color, and carries out the regurgitation for every nozzle.
[Claim 12] The color filter characterized by being manufactured by the manufacture approach of a color filter according to claim 1 to 10.
[Claim 13] The liquid crystal device characterized by being the liquid crystal device which comes to pinch liquid crystal, and constituting one substrate using a color filter according to claim 12 between the substrates of a pair.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the manufacture approach of a color filter and manufacturing installation which give ink on a transparence substrate with an ink jet method, and form the coloring section. Furthermore, this invention relates to the liquid crystal device using the color filter by this manufacture approach, and this color filter.
[0002]
[Description of the Prior Art] Generally, a liquid crystal display is carried in a personal computer, a word processor, a pachinko play base, an automobile navigation system, small television, etc., and need is growing in recent years. However, the price of a liquid crystal display is high and the demand to the cost cut has become strong every year.
[0003] In order for the color filter used for a liquid crystal display to arrange each pixel (coloring section), such as red (R), green (G), and blue (B), to constitute it on a transparence substrate and to raise display contrast to the perimeter of each of these pixels further, the black matrix for carrying out optical electric shielding is established.
[0004] As the manufacture approach of a color filter, conventionally, there are a staining technique, a pigment-content powder method, an electrodeposition process, etc., and the approach of forming by print processes or the ink jet method is further proposed from the demand to a cost cut. However, in print processes, in order to repeat the process of an imprint and desiccation 3 times for every pixel of R, G, and B from the printing version and to form a color filter, there was a problem that a yield fell.
[0005] On the other hand, about the ink jet method, the approach of an ink jet method giving the coloring liquid containing the coloring matter of three colors of R, G, and B on a substrate, making JP,59-75205,A dry each coloring liquid, and forming the coloring section in it, for example is proposed. By such ink jet method, since each pixel of R, G, and B can be formed at one process, a large cost cut can be aimed at with simplification of a large production process.
[0006]
[Problem(s) to be Solved by the Invention] In the manufacture approach of the color filter by the ink jet method, as for a coloring process, time amount is sharply shortened by using the ink jet head which has two or more nozzles for every color. However, when a color filter is formed using two or more nozzles, it is easy to produce the irregular color for every pixel, and it is visible to the concentration to which the boundary section of the scan field which sets a large-sized color filter by the number of a nozzle, divides into two or more scan fields, and adjoins when a coloring scan is carried out differs from other parts especially in many cases.
[0007] The coloring field in the case (it draws) of dividing the above-mentioned coloring field into two or more scan fields, and giving ink and the relation of an ink jet head are typically shown in drawing 1 . Among drawing, in the whole coloring field, and 3a-3c, a scan field and 4 show the scanning direction of an ink jet head, and, as for 1a-1c, 5 shows [the ink jet head of each color of R, G, and B, and 2] the shift direction of an ink jet head. In drawing 1 , making the scanning direction 4 in drawing scan R, G, and the B1 set ink jet heads 1a-1c to each scan fields 3a-3c of the substrate which forms the coloring section of a color filter, ink is given to a predetermined covering color part from each nozzle, and the coloring section is formed. As shown in drawing 1 , when a large-sized substrate cannot give ink to the coloring field 2 whole only by migration of a scanning direction 4, the ink jet heads 1a-1c can be shifted in the shift direction 5 in drawing, and are made to scan again. Therefore, the coloring field 2 is divided into the scan fields

3a-3c by the shift position of the ink jet heads 1a-1c. Moreover, corresponding to each scan fields 3a-3c, the coloring scan of the coloring field 2 whole can also be performed in a short time by preparing three sets of sets of the ink jet heads 1a-1c, without shifting an ink jet head.
[0008] Boundary A exists between the scan fields which adjoin in the case of which, and an irregular color tends to be observed by viewing in this boundary A and the circumference (boundary section) of it. It is possible that the pixels near [concerned] the boundary A differ as the cause in the pixel which is distant from this boundary, and the following points.
[0009] (1) In the boundary section, the time lag which the pixel of a different field is colored, respectively is large.
[0010] (2) Since the location of the nozzle which gives ink to the pixel of the boundary section is greatly separated also within the ink jet head when shifting an ink jet head and using it, the difference in the physical quantity of a liquid ink drop measure, an impact location, etc. which carries out the regurgitation is greater than the approaching nozzles.
[0011] (3) When using the set of a different ink jet head for every scan field, the difference in the physical quantity of a liquid ink drop measure, an impact location, etc. which carries out the regurgitation from the nozzle of a different ink jet head is greater than the nozzle of the same ink jet head.
[0012] The approach of giving ink to the resin constituent layer which roughly divides and has ink absorptivity those with two kind and the first as the manufacture approach of the color filter using an ink jet method, coloring this resin constituent layer, and making it into the coloring section, and the second are the approaches of giving ink to the field surrounded in the septum section, hardening this ink itself, and making it into the coloring section. In each approach, the mechanism from which the difference arising from the above ink jet heads and nozzles causes an irregular color is presumed as follows.
[0013] (The 1st approach)
(a) Since the scan field which carried out the coloring scan previously has the time amount longer than the next scan field which results in the following process (the desiccation process of ink, and hardening process of a resin constituent layer) when shifting an ink jet head and using it, distribution of a coloring matter differs and affect observation by viewing.
[0014] (b) It is immersed to the pixel which the component of ink adjoins exceeding the boundary section with time amount progress from a pixel, and affect distribution of the coloring matter in a contiguity pixel, and the coloring matter distribution in a contiguity pixel differs as a result, and affect observation by viewing.
[0015] (c) The difference in an impact location affects the coloring matter distribution in a pixel, and affects observation by viewing.
[0016] (The 2nd approach)
(d) It becomes the difference in the thickness which is a pixel, and the difference in the amount of ink given produces a concentration difference, and affects observation by viewing.
[0017] (e) The difference in an impact location produces the bias of thickness in a pixel, produces a concentration difference, and affects observation by viewing.
[0018] In order to mitigate the effects of the irregular color of the boundary section including these factors, the method of the scan of multiple times performing the coloring process of 1 scan field, shifting an ink jet head a little for every scan, overlapping a part of adjoining scan field, and distributing the effect of the boundary section is effective. The coloring field in that case is typically shown in drawing 2 . Among drawing 2 , six are a duplication field and gave the same sign to the same member as drawing 1 . An ink jet head is shifted in the shift direction for every 3 scan deed and scan, overlapping adjoining scan field 3a and scan field 3b through the duplication field 6, and giving every [of the required amount of ink / 3 / 1/] by one scan, respectively, as shown in drawing 2 . Consequently, ink will be given to each covering color part from three different nozzles.
[0019] However, even if it does in this way and colors, in the duplication field concerned, a gently-sloping irregular color may be spatially observed by viewing.
[0020] The purpose of this invention is to prevent the irregular color of the boundary section of the contiguity scan field generated by dividing a coloring field into two or more scan fields in the manufacture approach of the color filter by the ink-jet method using the ink-jet head which has two or more nozzles, and is to offer the color filter of the high quality by the manufacturing installation and this manufacture approach of using for this manufacture approach further, and offer the liquid crystal device which is excellent in color display using this color filter.
[0021]

[Means for Solving the Problem] In the process which this invention is the manufacture approach of the color filter which gives ink to the covering color part on a transparence substrate with an ink jet method, and forms the coloring section, and gives two or more liquid ink drops for every covering color part Ink is given at coincidence to two or more covering color parts using the ink jet head which has two or more nozzles for every color. It is the manufacture approach of the color filter which divides a coloring field into two or more scan fields parallel to the scanning direction of an ink jet head, and is characterized by setting up so that the amounts of ink given by the covering color part of the boundary section of an adjoining scan field and covering color parts other than this boundary section may differ at least.

[0022] Moreover, this invention is the color filter manufacturing installation equipped with the stage in which a transparence substrate is laid, and the ink jet head which gives ink to the covering color part on this substrate, and the above-mentioned ink jet head has two or more nozzles for every color, and offers the manufacturing installation of the color filter characterized by having a means to control independently the amount of ink which carries out the regurgitation for every nozzle.

[0023] Furthermore, it is the color filter characterized by manufacturing this invention by the manufacture approach of the color filter of above-mentioned this invention, and the liquid crystal device which comes to pinch liquid crystal between the substrates of a pair, and the liquid crystal device characterized by constituting one substrate using the color filter of this invention is offered, respectively.

[0024]

[Embodiment of the Invention] In this invention, the boundary section of an adjoining scan field means the field which the irregular color observed by viewing including the boundary and the circumference of the scan field which adjoins when it manufactures by the conventional manufacture approach tends to generate. Here, the case where divide into each covering color part to three scan fields, and ink is given to the transparence substrate with which the covering color part with a color [each] of 600 pixels was located in a line in the shift direction in the stripe pixel array is mentioned as an example, and is explained. In addition, in the following explanation, only the number of pixels of one color is shown for convenience.

[0025] Drawing 3 is drawing showing the coloring field at the time of giving ink from the same nozzle for every covering color part, and giving ink by one scan about each scan field, respectively. Since 200 pixels of ink are given at a time in each scan field, Boundary A exists, respectively between the 200th pixel and the 201st pixel and between the 400th pixel and the 401st pixel, and the field of the circumference t of it affects observation by viewing. When the color filter with an irregular color was observed, there were many to which an irregular color exists [t] in the range of about 10mm of both ends from the physical location-boundary A. Therefore, it considers as the boundary section which starts the boundary section in the shift direction from the boundary A of a scan field, and starts this invention in this range 10mm of both ends at least since almost all irregular color range is included when it is preferably defined as the range of 30mm still more desirably 20mm.

[0026] Moreover, in drawing 3 , as well as the above when you give ink to each scan field by the scan of multiple times, let the range of 30mm be the boundary section still more desirably 20mm preferably 10mm to both ends a core [the boundary A of an adjoining scan field]. Moreover, any are sufficient even from a nozzle which is different in this case even from the nozzle with the same grant of the ink of the multiple times to each covering color part.

[0027] Moreover, a part of adjoining scan field is overlapped, and by giving ink to drawing 4 by the scan of multiple times about each scan field, and being able to shift an ink jet head in the shift direction for every scan shows typically the coloring field in the case of giving ink from the nozzle to which the same number differs from the count of a scan in each covering color part. 6a and 6b are duplication fields among drawing. When the duplication fields 6a and 6b are made into 40 pixels for example, in the shift direction, it is considered that the boundary between scan fields is 40 pixels of the duplication field concerned, and, therefore, the range of the boundary section is 30mm desirably 20mm preferably 10mm (t= in drawing) of both sides in the shift direction from the edge of this duplication field and the duplication field concerned.

[0028] Moreover, if the overlapping number of pixels is increased, substantially, it shall be considered that all coloring fields are the boundary sections, and they shall also include such a configuration in this invention.

[0029] There is the 2nd approach of giving ink to the resin constituent layer which has ink absorptivity, giving ink to the 1st approach of coloring this resin constituent layer and making it into the coloring section and the field surrounded by the septum member, hardening this ink itself, and making it into the coloring section, as described above as the

manufacture approach of the color filter by the ink jet method concerning this invention. Each approach is listed to below and a desirable example is explained to it.
[0030] (The 1st approach) As the 1st approach, more specifically On a transparence substrate, the resin constituent layer which falls or increases ink absorptivity by an optical exposure or an optical exposure, and heat treatment is formed, and optical exposure or optical exposure, and heat treatment are performed to the predetermined field of this resin constituent layer. The high covering color part of ink absorptivity, The method of forming the low non-coloring section of ink absorptivity, an ink jet method giving ink to the above-mentioned covering color part, coloring this covering color part, forming the coloring section, and making the whole resin constituent layer perform and harden an optical exposure or heat treatment is more desirable than this covering color part.
[0031] An example of the process of this approach is shown in drawing 5 . Drawing 5 is process drawing at the time of using the resin constituent to which ink absorptivity falls by an optical exposure or an optical exposure, and heat treatment (or disappearance). Hereafter, each process is explained. In addition, (a) - (f) of drawing 5 is a cross section corresponding to following process (a) - (f), respectively.
[0032] Process (a)
The black matrix 12 is formed on the transparence substrate 11. Although a glass substrate is generally used as a substrate 11, if it has need properties, such as transparency as a color filter, and a mechanical strength, it will not be limited to a glass substrate.
[0033] Moreover, even if it forms a black matrix on this resin layer after coloring the resin constituent layer 13 after it forms the resin constituent layer 13 mentioned later or, there is especially no problem. Moreover, although the approach of forming a metal thin film by the spatter or vacuum evaporationo, and carrying out patterning according to a FOTORISO process as the formation approach is common, it is not limited to it.
[0034] Process (b)
On a substrate 11, it hardens by an optical exposure or an optical exposure, and heat treatment, and the resin constituent with which the ink absorptivity of an optical exposure part falls is applied, it prebakes if needed, and the resin constituent layer 13 is formed. As base material resin of such a resin constituent, although resin, such as acrylic, an epoxy system, and an amide system, is used, it is not limited to especially these. In order to advance crosslinking reaction according to concomitant use of light or light, and heat by these resin, it is also possible to use a photoinitiator (cross linking agent). As a photoinitiator, dichromate, a bis-azide compound, a radical system initiator, a cation system initiator, an anion system initiator, etc. are usable. Moreover, these photoinitiators can be mixed or it can also be used combining other sensitizers. Furthermore, it is also possible to use together photo-oxide generating agents, such as an onium salt, with a cross linking agent. In addition, in order to advance crosslinking reaction more, you may heat-treat after an optical exposure.
[0035] Moreover, the methods of application, such as a spin coat, a roll coat, a bar coat, a spray coat, and a DIP coat, can be used for formation of the resin constituent layer 13, and it is not especially limited to it.
[0036] Process (c)
By performing pattern exposure in the resin constituent layer of the field shaded by the black matrix 12 using a photo mask 14, it is made to harden, ink absorptivity is reduced and the non-coloring section 15 is formed. In the field which was not exposed, ink absorptivity serves as the covering color part 16 high. Although the non-coloring section 15 is not necessarily required, the color mixture between the adjoining coloring sections can be prevented by making the low non-coloring section 15 of ink absorptivity intervene between the adjoining covering color parts 16. Although what has opening for stiffening the protection-from-light part by the black matrix 12 is used for the photo mask 14 used here, in order that it may prevent the color omission in the part which touches the black matrix 12, it is desirable to use the mask which has opening narrower than the protection-from-light width of face of a black matrix.
[0037] Process (d)
From the ink jet head 17, the ink 18 of each color of R, G, and B is given to the covering color part 16 according to a predetermined coloring pattern, and the coloring section (pixel) 19 is formed. In this invention, the amount of ink given for every covering color part is controlled.
[0038] As ink used for coloring, it is possible to use a pigment system and a pigment system, and although liquefied ink and solid ink are usable, when using water color ink, it is desirable to form the resin constituent layer 13 with the high resin constituent of absorptivity. Moreover, it is ink solidified in ordinary temperature less than [not only the thing of a liquid but a room temperature, or it], and since a temperature control is performed for ink itself within the limits of 30

degrees C - 70 degrees C and the viscosity of ink is controlled by the thing to soften at a room temperature, the thing which is a liquid, or the usual ink jet method in the stable range, that to which ink makes the shape of liquid is suitably used at the time of the ink regurgitation.
[0039] Furthermore, as an ink jet method, the bubble jet type which used the electric thermal-conversion object as an energy generation component, or the piezo jet type using a piezoelectric device is usable, and coloring area and a coloring pattern can be set as arbitration.
[0040] Process (e)
After drying ink if needed, an optical exposure is carried out all over a substrate, and the coloring section 19 is stiffened. You may heat-treat instead of an optical exposure.
[0041] Process (f)
A protective layer 20 is formed if needed. It is usable, if the inorganic film formed of a resin layer a photo-curing type, a heat-curing type, or light-and-heat concomitant use type, vacuum evaporationo, a spatter, etc. can be used as a protective layer 20, it has the transparency at the time of considering as a color filter and a subsequent ITO formation process, an orientation film formation process, etc. can be borne.
[0042] When using the resin constituent which ink absorptivity increases by an optical exposure or an optical exposure, and heat treatment (or manifestation) as a resin constituent, moreover, as such a resin constituent The system which specifically uses the reaction by chemistry magnification is desirable. As base material resin Hydroxypropylcellulose, By a thing or an acetyl group etc. which esterified the hydroxyl group of cellulosics, such as hydroxyethyl cellulose What was blocked ; Novolak resin, such as a thing (example: compound of polyvinyl acetate system etc.); cresol novolak blocked by a thing or an acetyl group etc. which esterified the hydroxyl group of giant-molecule alcohol, such as polyvinyl alcohol, and those derivatives, (Example: Compound of an acetic-acid cel roll system etc.) Although what blocked PORIPARA hydroxystyrene and the hydroxyl group of those derivatives for example, by the trimethylsilyl radical is used, this invention is not limited to these.
[0043] In this invention, in order to make ink absorptivity produce a substantial difference by exposure, it is desirable that the conversion rate to the hydrophilic group of a functional group convertible into a hydrophilic group is generally 30% or more. As hydrophilic-group assay in this case, analyses of a spectrum, such as IR and NMR, are effective.
[0044] Moreover, what is necessary is not to be limited to these and just to consist of a presentation which the ink absorptivity of an optical exposure part increases by an optical exposure or an optical exposure, and heat treatment as a result as a photoinitiator, although halogenation organic compounds, such as onium salts, such as triphenylsulfonium hexafluoroantimonate, and TORIKURORO methyl triazine, naphthoquinonediazide, or its derivative is used suitably.
[0045] Moreover, when such a resin constituent is used, the black matrix formed on the transparence substrate can be used as a mask, and it can also expose except the field shaded by the black matrix by exposing from a rear face.
[0046] (The 2nd approach) Drawing 6 is process drawing of the 2nd approach, and gave the same sign to the same member as drawing 5 . Moreover, (a) - (d) of drawing 6 is a cross section corresponding to following process (a) - (d).
[0047] Process (a)
First, a septum member is formed on the transparence substrate 11. When a septum member gave the ink mentioned later, it is a member for avoiding color mixture with the ink of an adjoining different color, and was made into the black matrix 22 which served as the protection-from-light layer with this operation gestalt. As the black matrix 22 concerned, patterning is preferably carried out by the general photolithography method using a black pigment content resist. This black matrix 22 gives ** ink nature preferably, in order to prevent that adjoining different ink is mixed, when the ink mentioned later is given. When the thickness of the black matrix 22 takes into consideration the above-mentioned septum operation and a protection-from-light operation in this invention, 0.5 micrometers or more are desirable. Moreover, opening of this black matrix 22 is a covering color part concerning this invention.
[0048] Process (b)
From the ink jet head 17, the ink 23 of each color of R, G, and B is given according to a predetermined coloring pattern so that opening of the black matrix 22 may be buried. In this invention, the amount of ink given for every opening and every covering color part in the process concerned is controlled.
[0049] The ink used by this invention is hardened by energy grant, and consists of a resin constituent which usually contains a coloring matter. A color and a pigment common as the above-mentioned coloring matter can be used, for example, anthraquinone dye, azo dye, triphenylmethane dye, and Pori methine dye ****** can be used as a color.
[0050] Moreover, as resin used for ink, the resin hardened by heat treatment or optical exposure isoenergetic grant is

used. Specifically, the combination of a well-known resin and a well-known cross linking agent can be used as heat-curing mold resin. For example, acrylic resin, melamine resin, a hydroxyl group or a carboxyl group content polymer and a melamine, a hydroxyl group or a carboxyl group content polymer, a polyfunctional epoxy compound and a hydroxyl group or a carboxyl group content polymer, a fibrin reaction type compound and an epoxy resin, resol mold resin and an epoxy resin, amines and an epoxy resin, a carboxylic acid or an acid anhydride, an epoxy compound, etc. are mentioned. Moreover, as photo-curing mold resin, a well-known thing, for example, commercial negative resist, is used suitably.

[0051] Various solvents can also be added to the above-mentioned ink. Especially, the mixed solvent of water and a water-soluble organic solvent is preferably used from the field of the dischargeability in an ink jet method.

[0052] Furthermore, in order to give the desired property other than the above-mentioned component if needed, a surfactant, a defoaming agent, antiseptics, etc. can be added and commercial water soluble dye etc. can be added further.

[0053] Moreover, if the regurgitation is possible also for what is not dissolved in water or a water-soluble organic solvent among the above-mentioned light or heat-curing mold resin to stability, it will not matter even if it uses solvents other than water or a water-soluble organic solvent. Moreover, when using the monomer of the type which carries out a polymerization especially by light, it can also consider as the non-solvent type which dissolved the color in the monomer.

[0054] Process (c)

The ink 23 given to opening of the black matrix 22 is stiffened by heat treatment, an optical exposure, or its both, and the coloring section 24 is formed.

[0055] Process (d)

A protective layer 20 is formed if needed.

[0056] In the process (d) of the 1st approach which described this invention above, and the process (b) of the 2nd approach In case ink is given to each covering color part, the liquid ink drop given to each covering color part is made into plurality. Ink shall be given at coincidence to two or more covering color parts using the ink jet head which has two or more nozzles for every color. And a coloring field is divided into two or more scan fields parallel to the scanning direction of an ink jet head, and it has the description to set up so that the amounts of ink given at least by the covering color part of the boundary section of an adjoining scan field and covering color parts other than this boundary section may differ. Therefore, it has the stage in which the transparence substrate which is the configuration member of a color filter is laid, and the ink jet head which gives ink to the covering color part on this substrate, and this ink jet head has two or more nozzles for every color, and the thing equipped with a means to control independently the amount of ink which carries out the regurgitation for every nozzle is used for the manufacturing installation of the color filter of this invention. Hereafter, an operation gestalt is mentioned and the process which gives ink to a transparence substrate is explained concretely.

[0057] (Operation gestalt 1) The production process of a color filter which has each color of 800 pixels in the shift direction of an ink jet head is mentioned as an example, and is explained. Drawing 7 is drawing showing the viewing area. In addition, in the drawing referred to in the following operation gestalten including this Fig., the same sign is given to the same part or same member as drawing 1 -4, and explanation is omitted. Moreover, the number of pixels shows only one color for convenience.

[0058] In this operation gestalt, the 800-pixel coloring field 2 is trichotomized to the scan fields 3a-3c in the shift direction. A is the boundary of an adjoining scan field. A nozzle gives ink for this coloring field 2 by the scan of multiple times for every scan field, using 300 ink jet heads each one color of every. In addition, the nozzle which gives the ink of multiple times is the same for every covering color part. Therefore, the nozzle which gives ink to the covering color part for the 300 pixels of every (for example, the 1st pixel, the 301st pixel, and the 601st pixel) shift directions is the same.

[0059] By measuring the amount of ink beforehand breathed out from each nozzle, the amount of ink given from each nozzle adjusts a liquid ink drop independently for every nozzle so that the amount of ink given to each covering color part may become fixed. Thus, an irregular color may be observed through the fixture with which only one color can observe the formed color filter by ****** and the boundary sections 31a and 31b including Boundary A. In such a case, for example, using a CCD camera etc., it photos two or more points at a time A circumference and the center section of the scan fields 3a-3c, respectively, and brightness is measured.

[0060] From the obtained brightness, the amount of ink given to the covering color part of each pixel of the boundary sections 3a and 3b is corrected. Since there is a possibility that a new irregular color may occur between the pixel which corrected the amount of ink in the color filter obtained after correction at this time, and the pixel which is not corrected, as for correction of the amount of ink, it is desirable to make it change with the locations of a pixel gently-sloping.
[0061] Thus, according to the generating situation of an irregular color, a color filter without an irregular color can be manufactured by changing the amount of ink of the covering color part of the boundary section at least.
[0062] (Operation gestalt 2) The example which divides and manufactures the same color filter as the operation gestalt 1 to two or more scan fields which overlap mutually is explained. The coloring field is typically shown in drawing 8 . With this operation gestalt, the ink jet head which has 206 nozzles for every color is used. Quadrisecting the coloring field 2, for scan field 3a, 206 pixels, and 3b and 3c are [230 pixels and 3d] 206 pixels in the shift direction 5, respectively, and the duplication fields 31a-31c are 24 pixels, respectively. Ink is given to each scan fields 3a-3d by scan 3 times, respectively, and since an ink jet head can be shifted in the shift direction 5 for every scan as shown in drawing 2 , ink is given from three nozzles from which each covering color part differs. Therefore, each nozzle is repeated in a cycle of 206 pixel in the shift direction. That is, if ink is given from the same nozzle as the covering (1st pixel, 207th pixel, 413rd pixel, and 619th pixel) color part and the nozzle at the left end of an ink jet head is made into the 1st as shown in drawing 8 for example, ink will be given from the 25th, the 13th, and the 1st nozzle. Hereafter, this period is called the period of a pixel configuration. Therefore, if the amount of transmitted lights is investigated about the continuous pixel 206 pixels or more, the measured value of the pixel of 800 pixel of the whole can be presumed.
[0063] As range which measures the amount of transmitted lights, as shown in drawing 9 , the continuous range 51 of 206 pixels or more over one boundary (duplication field) 31a (or 31b, 31c) is desirable at least, but measuring range may be divided into the plurality beyond two or it of 51a and 51b as shown, for example in drawing 10 .
[0064] In addition, although measurement of the amount of transmitted lights of a scanning direction should just be 1 pixels or more, it is desirable to choose two or more pixels of the location distant to some extent, and to average them, and it measures it 30 pixels or more desirably 10 pixels or more preferably.
[0065] As for the color filter whose drawing 11 is the mimetic diagram of the measurement machine of the amount of transmitted lights and whose 44 41 in drawing is a CCD camera and an X-Y stage with 42 [transparent / the light source and 43], and is a measurement board-ed, and 45, the driver of X-Y stage 43 and 46 are computers.
[0066] Moreover, drawing 13 is the extention mimetic diagram of the color filter circumference at the time of the amount measurement of transmitted lights. The color filter concerned is obtained at the process of drawing 5 , and 47 in drawing is the lens of a CCD camera. At this time, it is desirable to carry out memory of the amount of transmitted lights of each pixel to a computer desirably as image data which consists of a unit smaller than a color filter pixel. The reason is that it can expand the selection width of face of processing, such as processing image data as data which took the amount distribution of ink in a pixel into consideration.
[0067] The light irradiated from the substrate side of a color filter penetrates the pixel (coloring section 19) of a color filter, and is detected by CCD camera 41, the AD translation of the quantity of light is carried out, and memory is carried out to a computer 46. This amount of transmitted lights is reflecting strictly the amount of ink given to the pixel, when the pixel is colored homogeneity, but when a pixel has concentration distribution, it is expected that the amount of ink and the amount of transmitted lights do not correspond correctly. Therefore, the amount of transmitted lights can be measured and an irregular color can be prevented by adjusting the amount of ink according to the data of the obtained amount of transmitted lights. The amount of grants of the ink to each covering color part may be determined by processing the data of this amount of transmitted lights as primary data depending on the magnitude and the form of a color filter pixel.
[0068] Moreover, by asking for the rate of change of the amount of transmitted lights accompanying the rate of change of the amount of ink beforehand, it is also desirable to adjust the amount of ink so that the whole of each pixel may become the same amount of transmitted lights.
[0069] any of the side which it set up so that a scanning direction might become parallel to either of the sides which constitute the periphery of a coloring field, as shown in drawing 8 , but constitutes the periphery of a scanning direction and the coloring field 2 in this operation gestalt as it is not limited to this especially in this invention and shown in drawing 13 -- although -- you may constitute so that it may not become parallel.
[0070] Moreover, the quality judging of the irregular color of a color filter can also be performed to coincidence by

using the measurement result of the amount of transmitted lights of a color filter pixel for evaluation of an irregular color in this way, and when the judgment result concerned is a defect, the desired value of the amount of ink quickly given to each covering color part can be reset up.
[0071] (Operation gestalt 3) This operation gestalt is the example constituted so that ink might be given to the scan fields 3a-3d set as the same number of pixels as the operation gestalt 2 from an ink jet different, respectively. The coloring field is typically shown in drawing 14 .
[0072] With this operation gestalt, as shown in drawing 14 , measuring range 51a-51c is set up so that all the boundary sections may be straddled at least, and all pixels are desirably measured in the shift direction. Moreover, about a scanning direction, 1 pixels [30 pixels or more] or more 10 pixels or more are measured desirably preferably.
[0073] (Operation gestalt 4) This operation gestalt gives the ink which used two ink jet heads alternately about the scan fields 3a-3d set as the same number of pixels as the operation gestalt 2. That is, 3d is colored with the respectively same ink jet head with scan field 3a, and 3c and 3b. Therefore, as the combination of a nozzle will be repeated in a cycle of 412 pixel and shown in drawing 15 , ink is given to the pixel [407th] covering color part from the respectively same nozzle (the 25th, the 13th, and the 1st) with the 1st pixel.
[0074] It is desirable to measure including the boundary section to which ink is given from a different nozzle as a measuring range of the amount of transmitted lights of the pixel in the case of this operation gestalt, and it is desirable to measure 412 pixels or more which continues ranging over the duplication fields (namely, boundary) 6a and 6b as shown in drawing 16 . Moreover, it is good also as measuring range 51a and 51b divided so that the duplication fields 6a and 6b might be straddled, respectively, as shown in drawing 17 . About a scanning direction, 1 pixels [30 pixels or more] or more 10 pixels or more are measured desirably preferably.
[0075] Next, the liquid crystal device constituted using the color filter of this invention is explained. Drawing 18 is the cross section of the operation gestalt of the active matrix liquid crystal component incorporating the color filter which formed drawing 19 of drawing 5 at the process of drawing 6 , respectively. In drawing 18 and drawing 19 , as for a common electrode and 63, the orientation film and 68 are liquid crystal compounds, and the orientation film and 65 gave [62 / a substrate and 66 / a pixel electrode and 67] the same sign to the same member as drawing 5 and drawing 6 .
[0076] Generally the liquid crystal device of color display sets a color filter side substrate (11) and a TFT substrate (65), and is formed by enclosing the liquid crystal compound 68. Inside one substrate of a liquid crystal device, TFT (un-illustrating) and the transparent pixel electrode 66 are formed in the shape of a matrix. Moreover, inside another substrate 11, a color filter layer is installed so that each coloring sections 19 and 24 of R, G, and B may arrange in the location which counters the pixel electrode 66, and the transparent common electrode 62 is formed on it at the whole surface. Although the black matrices 12 and 22 are usually formed in a color filter side, they may be formed in a TFT substrate side in a BM on-array type liquid crystal device. Furthermore, the orientation film 63 and 67 is formed in the field of both substrates, and a liquid crystal molecule can be made to arrange in the fixed direction by carrying out rubbing processing of these.
[0077] A polarizing plate (un-illustrating) pastes the outside of substrates 11 and 65, respectively, and it displays by generally operating a liquid crystal compound as an optical shutter to which the permeability of back light light is changed, using the combination of a fluorescent lamp (un-illustrating) and a scattered plate (un-illustrating) as a back light.
[0078] In the liquid crystal device of this invention, the material, process, etc. can apply the technique of the conventional liquid crystal device about other configuration members that what is necessary is just to constitute using the color filter of this invention.
[0079]
[Example] (Example 1) In this example, it considered as the stripe pixel array and the color filter which has the pixel of 800 pixel x3 color in the shift direction of an ink jet head was produced.
[0080] First, in accordance with the process of drawing 5 , on the transparence substrate, the black matrix and the resin constituent layer were formed, pattern exposure was carried out, and the non-coloring section and a covering color part were formed. The ink jet head measured beforehand the amount of ink breathed out from each nozzle using what has the nozzle of each 300 colors, and it adjusted the number of liquid ink drops so that the amount of ink given to each covering color part might become fixed. As the coloring field was divided in the shift direction to the scan field (each color of 300 pixels, 300 pixels, and 200 pixels) and one nozzle was equivalent to one covering color part, the covering

color part was colored. Then, the whole resin constituent layer was hardened and the color filter was obtained.
[0081] When the obtained color filter was observed by viewing, it turned out that the boundary sections 31a and 31b which include the boundary A between scan fields about B (blue) pixel as shown in drawing 7 are thin. Then, using the CCD camera, it photoed 10mm angle area of the boundary section, and the other ten 10mm angle area at a time, respectively, and the brightness was measured. Consequently, it turned out that the direction of the boundary sections 31a and 31b is bright.
[0082] Then, it set up so that the pixel of the amount of ink nearest to Boundary A might increase 3%, and the amount of grants of the ink to each pixel for 24 pixels (width of face of 7.4mm) was corrected so that the augend of the amount of ink might become less gradually, as it separated from Boundary A. Similarly, the amount of ink was corrected also about R (red) pixel and G (green) pixel. About the color filter manufactured after correction, the irregular color of the boundary section was not accepted in viewing.
[0083] (Example 2) A covering color part and the non-coloring section were formed in the resin constituent layer, like the example 1, as shown in drawing 8 , it quadrisected into the scan field which has the field which overlaps a coloring field mutually, and ink was given using the ink jet head which has the nozzle of each 206 colors. The number of pixels of the shift direction of a scan field was made into each color of 206 pixels, 230 pixels, 230 pixels, and 206 pixels, and the duplication field was made into 24 pixels. The scan gave ink to each scan field 3 times, and the ink jet head was able to be shifted by 12 nozzles for every scan.
[0084] The whole resin constituent layer was stiffened after the coloring process, and the amount of transmitted lights was measured about 300 pixels which continues about the obtained color filter ranging over one duplication field as shown in drawing 9 using the measurement machine of drawing 11 . It measured and averaged about 3 pixels left 1 pixel about the scanning direction. Distribution with an amount [of transmitted lights] of B pixels is shown in drawing 20 . As shown in drawing 20 , it turned out that the amounts of transmitted lights differ greatly focusing on the 183rd - the 230th pixel whose color filter of this example is a boundary between scan fields. Then, based on the data concerned, the amount of ink grants to the covering color part of the pixel concerned was corrected so that the amount of transmitted lights of the 183-230th pixels might be set to 1.00. Similarly, the amount of transmitted lights was measured also about R pixels and G pixels, and the amount of ink grants was corrected. The irregular color by viewing was not accepted about the color filter manufactured after correction.
[0085]
[Effect of the Invention] As mentioned above, as explained, according to this invention, in the color filter divided and colored two or more scan fields, the irregular color generated in the boundary section can be prevented. Moreover, by incorporating this invention in a production line, it can respond to generating of an irregular color promptly, and a high yield can be maintained. Therefore, it becomes possible to offer cheaply the liquid crystal device excellent in the color display property using the color filter of this invention.

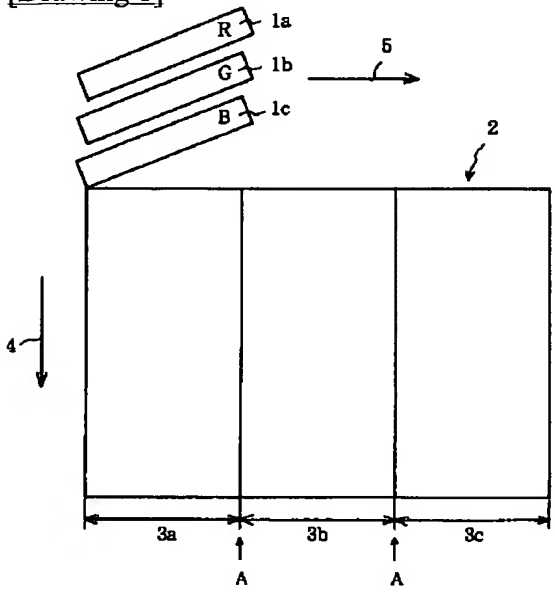
[Translation done.]

* NOTICES *

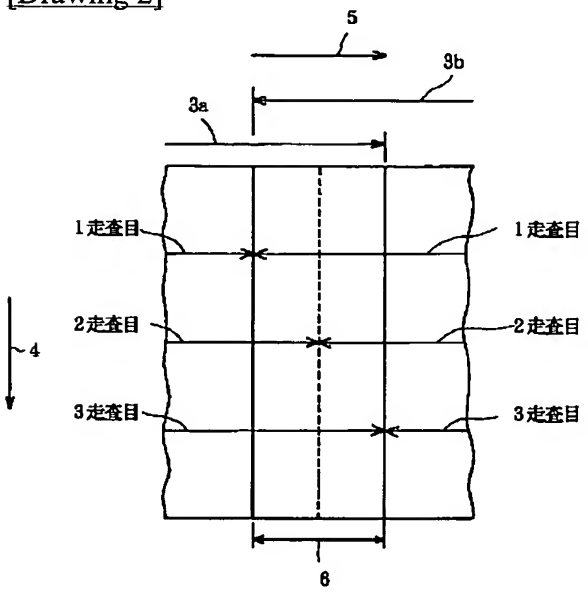
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

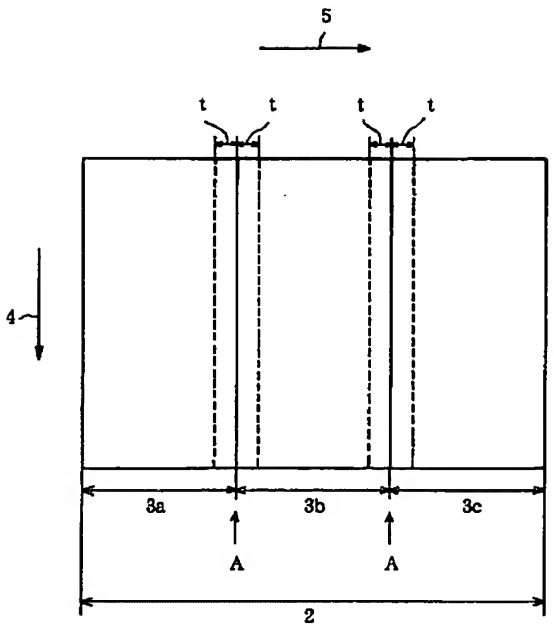
[Drawing 1]



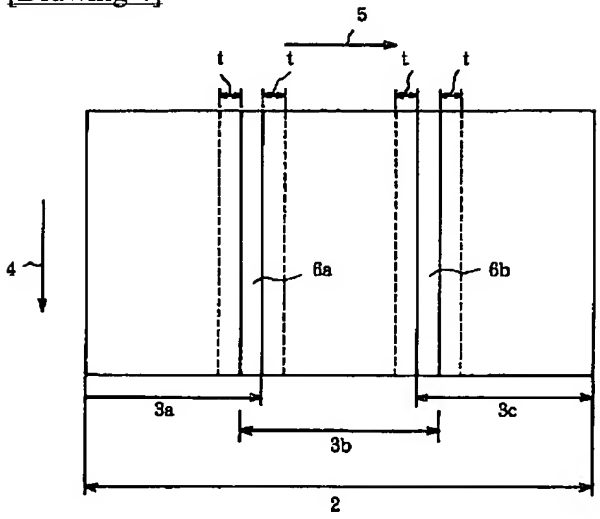
[Drawing 2]



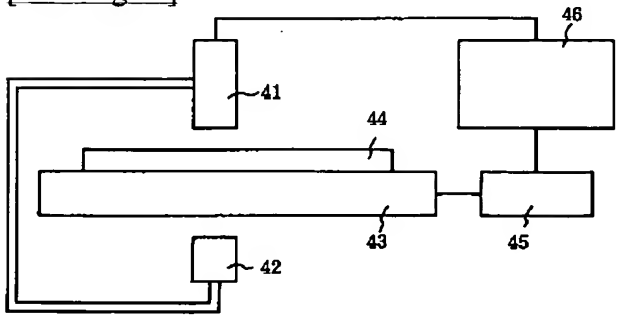
[Drawing 3]



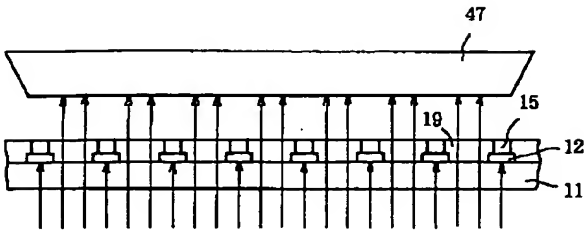
[Drawing 4]



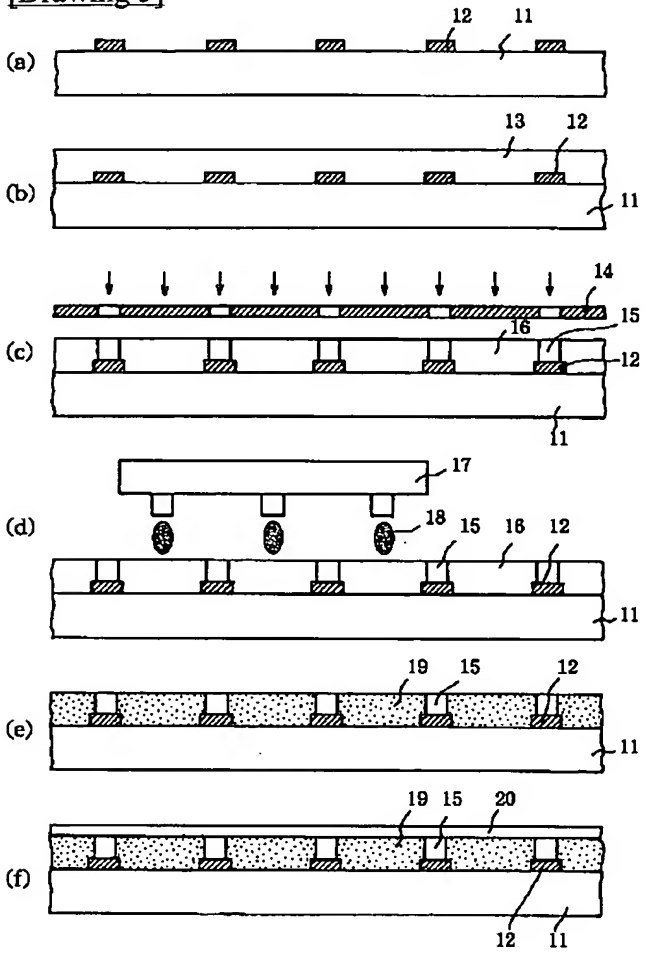
[Drawing 11]



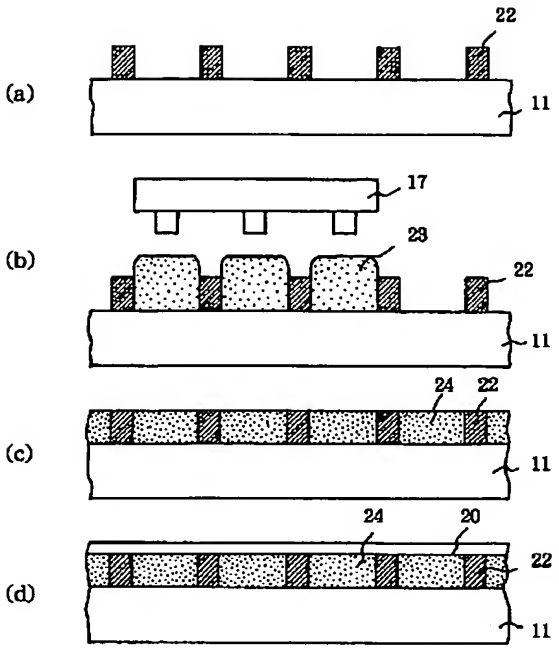
[Drawing 12]



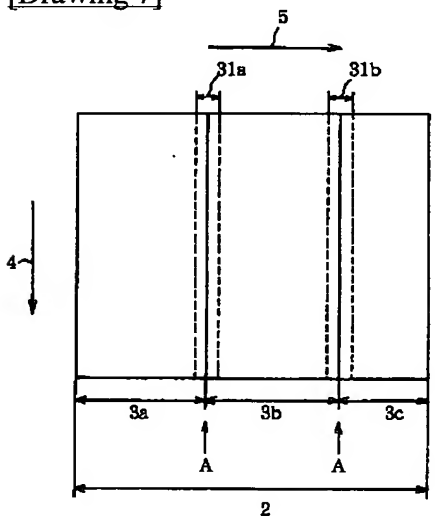
[Drawing 5]



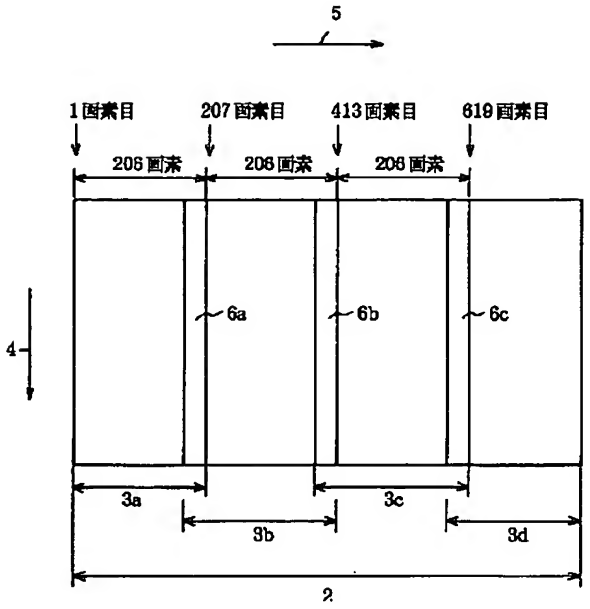
[Drawing 6]



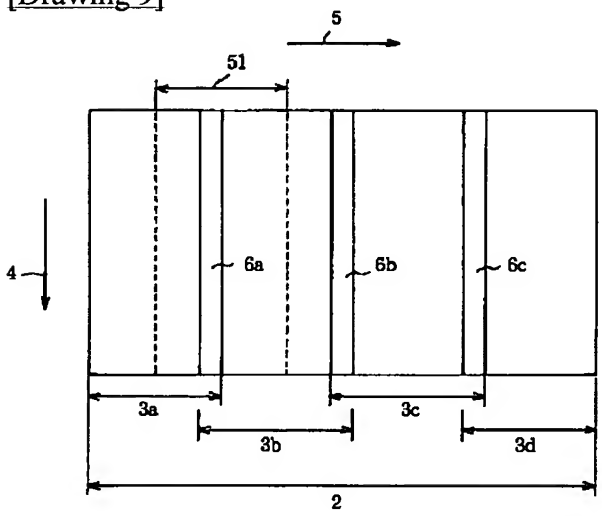
[Drawing 7]



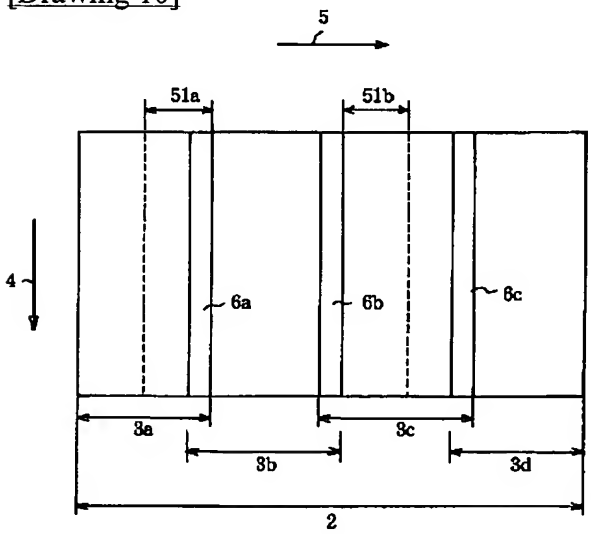
[Drawing 8]



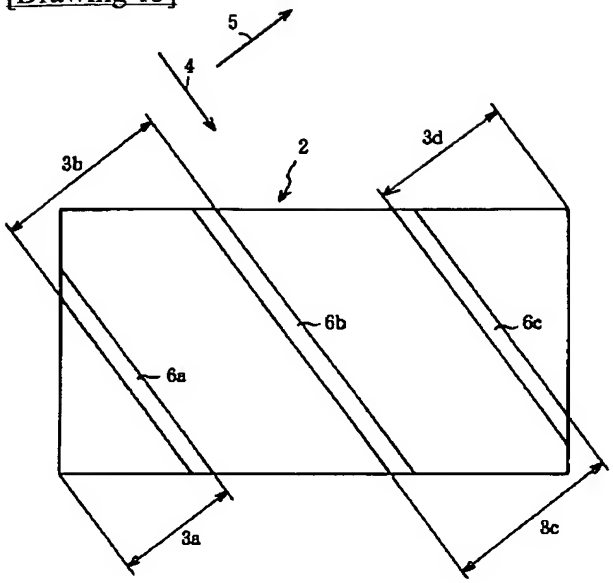
[Drawing 9]



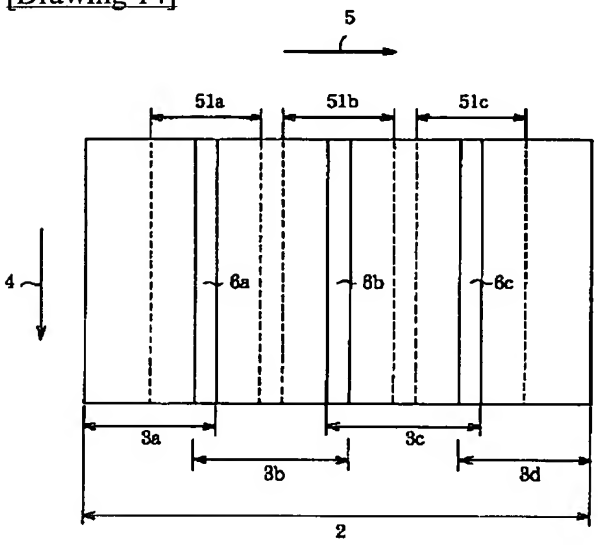
[Drawing 10]



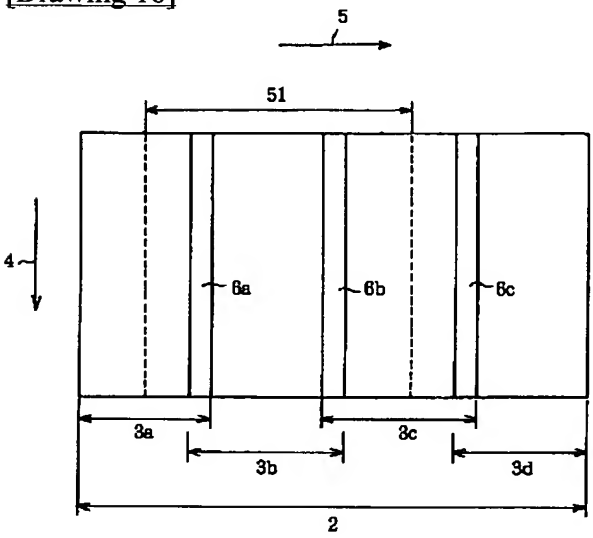
[Drawing 13]



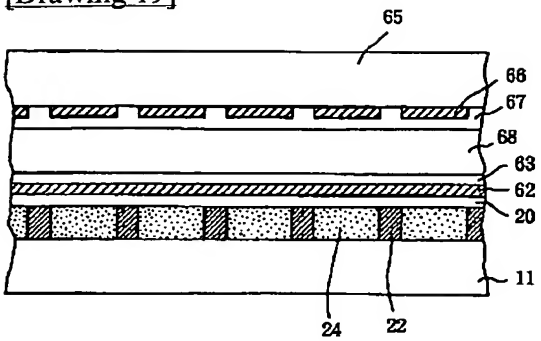
[Drawing 14]



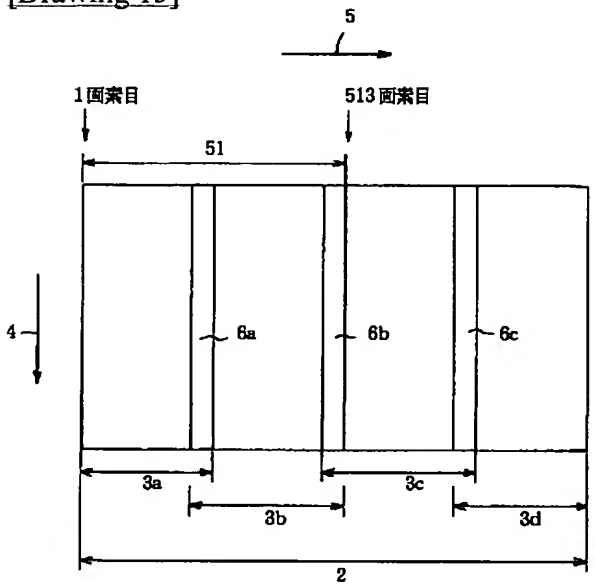
[Drawing 16]



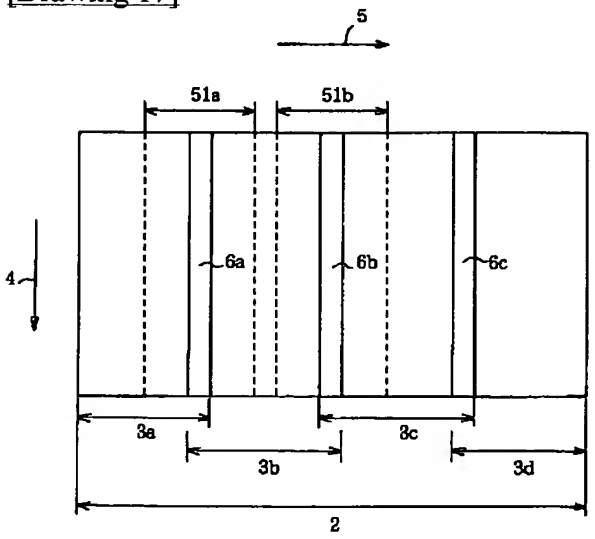
[Drawing 19]



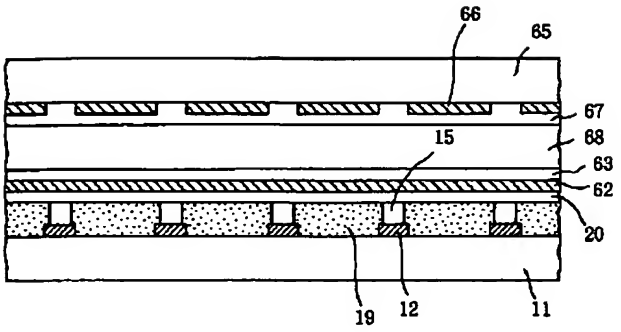
[Drawing 15]



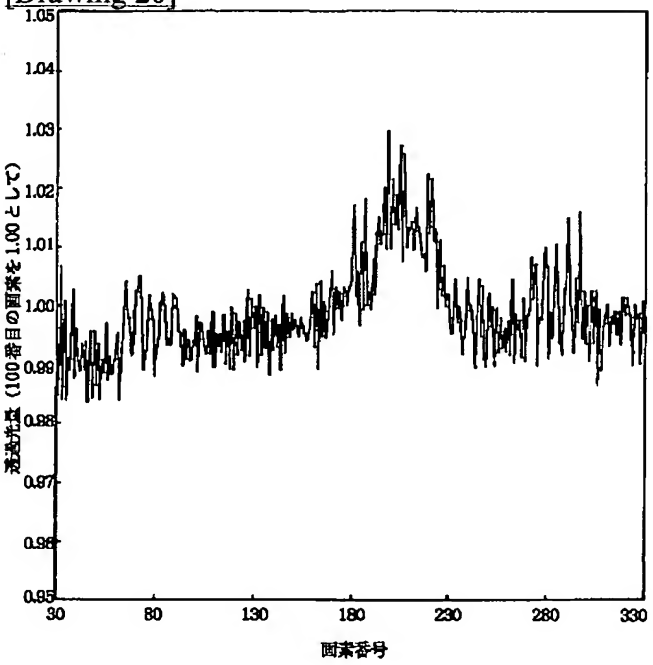
[Drawing 17]



[Drawing 18]



[Drawing 20]



[Translation done.]